Great Lakes
Binational Toxics Strategy
Assessment of Level 1 Substances
Summary

December 2005

DISCLAIMER

This report is a product of the Great Lakes Binational Toxics Strategy. Participants in the process include a diverse group from government, industry, environmental organizations, and interested citizens. The report does not necessarily reflect the views of the Environmental Protection Agency or of Environment Canada, and no official endorsement should be inferred. The mention of trade names or commercial products constitutes neither endorsement nor recommendation of use.

Table of Contents

Executive Summary

The Great Lakes Binational Toxics Strategy (GLBTS) was signed by the United States and Canada (the Parties) in 1997 to advance the goals of Article II(a) of the Great Lakes Water Quality Agreement (GLWQA). The Strategy focus has been on persistent toxic substances (PTS) in the Great Lakes ecosystem, in particular those chemicals which bioaccumulate up the food chain, and Article II(a) includes the goal that "the discharge of any or all persistent toxic substances be virtually eliminated". The GLBTS sets forth seventeen (17) interim reduction goals for twelve "Level 1" PTS over a ten year time-frame which ends in 2006.

In anticipation of this important milestone, in 2004, the Parties, working with many stakeholders from industry, non-governmental organizations, Provinces, States, Tribes, cities and academia, commenced an overall program review of each of the Level 1[1] substances, to review progress made to date in reducing these substances and to explore future directions for the continued management of these substances. This report provides a concise summary of each substance review. This report also addresses two non-substance-specific goals in the GLBTS: 1) to assess atmospheric inputs of Level 1 substances from world-wide sources, and 2) to complete or be well advanced in remediation of priority sites with contaminated bottom sediments in the Great Lakes Basin by 2006.

The substance reviews include two major parts[2]: 1) an overall environmental assessment of Level 1 substances in the Great Lakes environment, including a review of current levels in Great Lakes media and biota, an evaluation of these levels against available health based/risk based criteria, historical trends and projected trends looking forward; and 2) a source reduction assessment that looks at use and emission reductions accomplished to date under the GLBTS against the original targets, as well as an analysis of the remaining source sectors, and further opportunities for the GLBTS and others to continue to effect reductions toward our ultimate goals of virtual elimination. Finally, these reviews provide recommendations to the Parties for the future management of each Level 1 substance.

General Outcomes

With regard to source reductions, much progress has been made to date. Of seventeen (17) reduction goals, ten have been met, three more will be met by 2006, and the remaining four will be well advanced toward their respective targets. Notwithstanding these accomplishments, much remains to be done to achieve the ultimate goal of virtual elimination in the Great Lakes.

Overall, the environmental analyses show many of the Level 1 substances remain in the Great Lakes environment at levels which exceed health based criteria, particularly mercury, PCBs, and the cancelled pesticides. These substances continue to impair the Great Lakes, and limit fish consumption, particularly among sensitive populations such as pregnant women and children, and among subsistence fishers.

[1] Mercury, PCBs, dioxins and furans, hexachlorobenzene (HCB), benzo(a)pyrene (B(a)P), octachlorostyrene (OCS), alkyl lead, mirex, aldrin/dieldrin, toxaphene, DDT, chlordane

[2] A description of the Management Framework is found in Appendix A of this document.

Our analyses suggest that source reduction opportunities remain for the "active substances" (i.e., substances for which we have ongoing workgroup activities), which include mercury, PCBs, dioxins and furans, HCB and B(a)P. With respect to the "inactive" (i.e., no ongoing workgroup activity) Level 1 substances, cancelled pesticides, alkyl lead, and OCS, the Parties have decided to suspend GLBTS workgroup activities indefinitely, pending periodic review, and to leverage other programs, as appropriate. However, these substances will continue to be tracked and monitored in the Great Lakes. Finally, the GLBTS will continue to monitor and report on progress of sediment remediation activities in Areas of Concern in the Great Lakes Basin, and will continue to study issues associated with long-range transport of toxic substances from world-wide sources, in order to better inform our priorities and identify necessary action steps to move forward.

Specific Recommendations

Below is a brief summary of management recommendations and future opportunities by substance/challenge. A more detailed discussion of these is presented within the body of this report.

Substance	Recommendation	Future Opportunities
Mercury	Continue Active Level 1 Status	Source reduction opportunities remain for the GLBTS Mercury Workgroup in the auto scrap, appliance, industrial equipment, and dental sectors. In addition, the GLBTS will continue to encourage and track efforts to reduce mercury releases in sectors with regulatory systems in place or under implementation (e.g., mercury cell chlor-alkali plants and coal-fired power plants).
PCBs	Continue Active Level 1 Status	Source reduction opportunities remain for the GLBTS PCB Workgroup to continue to encourage decommissioning of in-service PCB equipment. Other significant future Workgroup opportunities include updating the current inventories, which will help in identifying additional intervention steps; mandatory dates for PCB phase out in Canada through voluntary activities (via the anticipated Canadian PCB phase out proposal scheduled for publication next year) and proposed regulatory amendments to existing Canadian PCB regulations; and incentives and recognition for PCB phase out and outreach programs.
Dioxins/ Furans	Continue Active Level 1 Status	Source reduction opportunities remain for the GLBTS Dioxin Workgroup to address the use of burn barrels. Other significant future Workgroup opportunities include characterization of sources such as uncontrolled burning, and exploring pathway interventions to mitigate exposure to dioxins and furans.
HCB	Continue Active Level 1 Status	Future Workgroup opportunities include continuing to update and improve the emissions inventories, identifying long-range transport contributions of HCB to the Great Lakes, and cooperating with the Dioxin Workgroup on similar source sectors to take advantage of the HCB reduction co-benefits that may also be achieved. The Workgroup should determine the co-benefits of reducing specified chlorobenzene compounds as a result of actions that reduce HCB.

B(a)P	Continue Active Level 1 Status	Source reduction opportunities remain for the GLBTS HCB/B(a)P Workgroup in residential wood combustion and scrap tire pile mitigation. Other significant future Workgroup opportunities may be identified through continued updating and improvement of emissions inventories. The Workgroup should determine the co-benefits of reducing Level 2 PAHs[3] resulting from activities that reduce B(a)P emissions.
Alkyl Lead	Suspend GLBTS Workgroup Activities	The Parties will refer to the National Programs to continue to work with National Association of Stock Car Auto Racing (NASCAR) to reduce the use of leaded fuel in race cars, and with the Federal Aviation Administration and aviation industry to find alternatives to leaded gasoline in aviation fuel.
Pesticides (aldrin/ dieldrin, chlordane, DDT, mirex, toxaphene)	Suspend GLBTS Workgroup Activities	The Parties will refer to National, Provincial, State, Tribal and local Clean Sweep programs to continue to address the stockpile of cancelled pesticides in the Great Lakes Basin, and to various remediation programs that address pesticide contamination. The Parties will participate in international fora that address pesticide phase-outs and disposal, world-wide.
OCS	Suspend GLBTS Workgroup Activities	The Parties will continue to monitor OCS in the Great Lakes environment, and study OCS via long-range transport.
Sediments	Continue Remediation Activities	The Parties will continue to report annually on progress made in the Areas of Concern to remediate sediments contaminated with Level 1 Substances
LRT	Continue Study of Long-Range Transport of Level 1 and 2 Substances	The Parties will continue to study the long-range transport of Level 1 and 2 substances to the Great Lakes, evaluate the relative contributions from world-wide sources, and work within international fora such as UNEP to reduce releases.

Conclusions

The GLBTS presents a unique model of how international cooperation and collaborative problem solving of issues that are beyond the reach of existing regulations can lead to real results in environmental protection. There may be an important ongoing role for the GLBTS, not only with respect to the current Level 1 substances, but also for newer chemicals of emerging concern. New innovative reduction strategies could be applied to the sources of current Level 1 PTS that can be eliminated from products and production processes as well as to additional chemicals that may fall under the scope of the GLBTS. The Parties intend to focus on next steps for the GLBTS in the coming months. Protecting the chemical integrity of the Great Lakes, advancing the goals of the Great Lakes Water Quality Agreement, and virtually eliminating PTS from the Great Lakes Basin are of paramount importance. The GLBTS is one important tool to move us toward these goals.

[3] Anthracene, Benzo(a)anthracene, Benzo(g,h,i)perylene, Perylene, Phenanthrene

1.0 Mercury

Challenge Goal Status

Both Canada and the U.S. have made significant progress in achieving reductions of mercury releases. Canada has reduced releases of mercury from anthropogenic sources in Ontario by approximately 84 percent (1988 baseline), against the goal of a 90 percent reduction. It is unlikely that Canada will meet its reduction goal by 2006. Mercury releases in Ontario have been cut by over 11,700 kilograms (kg) since 1988, based on Environment Canada's 2002 mercury inventory. The U.S. release challenge applies to the aggregate of air releases nationwide and to releases to the water within the Great Lakes Basin. According to the most recent National Emissions Inventory (NEI) estimates, U.S. mercury emissions decreased approximately 45 percent between 1990 and 1999, against a challenge goal of 50 percent. If an estimate of gold mining emissions is included in the 1990 inventory, the estimated reduction increases to 47 percent. By 2006, additional regulations and voluntary activities are expected to reduce U.S. mercury emissions by at least 50 percent (from the 1990 baseline), meeting the challenge goal.

On May 18, 2005, U.S. EPA published the world's first regulations limiting mercury emissions from coal fired power plants. Under the Clean Air Mercury Rule (CAMR), states are required to implement regulations that will reduce power plant mercury emissions 21 percent nationally by 2010, and 69 percent eventually. States can choose to participate in a national mercury emissions allowance trading program, or to achieve required reductions through emissions standards. Under the allowance trading program, power plants will be able to "bank" unused emissions allowances for later use, creating an incentive for reductions beyond the required 21 percent between 2010 and 2017. Use of these banked allowances after 2018, when the emissions "cap" is lowered to 15 tons (69 percent below the current level), will allow emissions to exceed the cap for some years beyond 2018. Trading of emissions allowances could cause emissions reduction amounts in some states to differ from the national average.

In June 2005, the Canadian Council of Ministers of the Environment (CCME) accepted in principle a draft Canada-wide standard (CWS) that would significantly reduce mercury emissions from the coal-fired electric power generation (EPG) sector. Final endorsement of the CWS by ministers is expected prior to the end of 2005.

This Canada-wide Standard consists of two sets of targets:

- Provincial caps on mercury emissions from existing coal-fired electric power generation plants, with the 2010 provincial caps representing a 65 percent national capture of mercury from coal burned, or 70 percent including recognition for early action.
- Capture rates or emission limits for new plants, based on best available control technology, effective immediately. Capture rates and emission rates are based on coal type. A 75 percent capture rate has been established for sub-bituminous coal and lignite, and an 85 percent capture rate has been established for bituminous coal and blends.

In Ontario, the 2010 CWS cap (kg/yr) is 0, and in June 2005 the Ontario provincial government also released a plan to phase out all coal-fired plants in Ontario. The first of five plants was closed in April 2005. Three of the remaining four plants will close in 2007, with the remaining station, Nanticoke GS to close in early 2009. Once all plants have been closed, a 100 percent reduction of emissions from this sector will be achieved in Ontario.

Mercury use (or consumption) in the U.S. has declined significantly since 1995. However, the exact amount is difficult to quantify because the U.S. Geological Survey (USGS) stopped reporting estimated U.S. mercury consumption after 1997. On the basis of data reported by the chlor-alkali industry and the lamp industry, it is estimated that mercury use declined by more than 50 percent between 1995 and 2003. This assumes that mercury use by other sectors remained constant between 1997 and 2003. This may underestimate the actual decline, considering likely reductions in the use of mercury in measurement and control devices, switches and relays, and dental amalgam that have not been quantified.

Environmental Analysis

Geographic Distribution, Temporal Perspectives, Criteria and Risk

The consideration of mercury in the environment is complicated by the need to sort through contributions from natural sources, those associated with legacy sources, and currently occurring anthropogenic sources. GLBTS mercury efforts have been focused on currently-occurring anthropogenic sources. The following points illustrate pieces of the mercury puzzle:

- Mercury levels continue to exceed risk-based criteria within the Great Lakes, most notably for methylmercury in fish and for sediment quality.
- Long-term trends (over 30 years) show a substantial decline (e.g., in herring gull eggs and sediments).
- Shorter term trends are less certain. In the past 10-20 years, mercury levels in fish, bald eagles, herring gull eggs, and atmospheric deposition have not declined.
- Mercury emissions decreased more than 40 percent in the U.S.
- Mercury releases in Ontario were reduced by 84 percent between 1988 and 2002.
- Mercury deposition data show no discernable decrease between 1995 and 2003.
- Mercury concentrations in biota are influenced not only by rates of mercury input into the environment, but also by factors that affect bioavailability and methylation of mercury.

One possible explanation for the lack of correspondence between the emissions trends and recent deposition trends is that reductions in deposition caused by North American emissions reductions have been offset by increases in deposition caused by global emissions. Trends of mercury concentrations in fish may not follow trends in mercury deposition, because mercury fish concentrations may be affected by mercury contributions from sediments, particularly in areas of past high direct water discharges.

Mercury is a major cause of fish consumption advisories in the Great Lakes Basin, with the highest mercury exposures caused by eating fish from certain inland lakes within the Basin. Therefore, continued efforts to reduce mercury inputs to the Great Lakes are warranted. Consumption of fish from the Great Lakes region adds to human body burdens of methylmercury, which often exceed health criteria. However, fish consumption also provides many health benefits, and in many cases Great Lakes fish are lower in mercury than other sources of fish. In the U.S., NHANES findings indicate that blood mercury levels in young

children and childbearing-aged women usually are below U.S. EPA's reference dose; however, blood mercury analyses for 16 to 49-year-old women showed that approximately 6 percent of women in the survey had blood mercury concentrations greater than 5.8 ug/L, a blood mercury level equivalent to the current U.S. EPA reference dose, or the level, following application of an uncertainty factor, at which exposure is considered unlikely to cause appreciable risk. In Canada, exceedances of health guidelines for mercury are comparatively rare, because Canada's guidelines are less restrictive than U.S. guidelines.

Sources of Mercury

Mercury inputs to the Great Lakes environment have been reduced significantly. However, a wide variety of sources continue to impact the Great Lakes, especially atmospheric deposition. Mercury deposition results primarily from releases to the air from past and current anthropogenic sources, both in North America and globally. Mercury from natural sources, emissions from current human activities, and re-emission of historic anthropogenic mercury, each contribute to mercury levels in the Great Lakes. In Ontario, the largest air emissions sources of mercury include electric power generation, iron and steel production, municipal waste (primarily land application of biosolids), cement and lime manufacturing, and incineration. In the U.S., the largest air emissions source of mercury is now coal-fired electric power generation. The recent regulatory action in the U.S. and a proposed draft Canada-wide standard may result in substantial reductions from this sector. (The recently promulgated Clean Air Mercury Rule on coal-fired power plants in the U.S. is under legal challenge.) Other sources of mercury in the U.S. include industrial boilers, production of gold and other metals, steel production using steel scrap, hazardous waste incineration, and chlorine production at mercury cell plants. In addition, mercury levels in some areas are elevated as the legacy of past contamination of water and sediments by direct water discharges of mercury.

Management Assessment

The GLBTS has identified a number of opportunities to reduce mercury releases to the Great Lakes Basin. Since mercury releases can be transported to the Great Lakes via the atmosphere from long distances, the GLBTS has also attempted to influence reductions across North America. The GLBTS can help promote reductions by continuing to share information about cost-effective reduction opportunities, tracking progress toward meeting reduction goals, including reductions achieved through various other programs and regulations, and publicizing voluntary achievements in mercury reduction. Particular attention will be paid to information-sharing in areas where mercury releases are significant but there are no existing federal regulations, or regulations are under development (e.g., contamination of metal scrap by mercury-containing devices, and their resulting emissions). The GLBTS will continue to encourage and track efforts to reduce mercury releases in sectors with regulatory systems in place or under implementation (e.g., mercury cell chlor-alkali plants and coal-fired power plants).

In addition, the GLBTS may have opportunities to promote mercury reduction beyond the U.S. and Canada, for instance by participating in the United Nations Environment Program's efforts to help developing countries identify sources of mercury and strategies for control. As North American releases decrease and global releases increase, an increasingly large share of mercury

inputs to the Great Lakes Basin will come from overseas sources. The GLBTS has yet to determine if new reduction targets and challenge goals are appropriate.

Management Outcome

The final management outcome for mercury is continued Active Level 1 status with periodic reassessment by the GLBTS. The Mercury Workgroup will: 1) disseminate information about removal of mercury devices in auto scrap, appliances, and industrial equipment; 2) assist state, provincial, and local governments identify cost-effective reduction approaches for mercury releases from dental offices; and 3) participate in national and international mercury reduction programs.

2.0 Polychlorinated Biphenyls (PCBs)

Challenge Goal Status

The GLBTS established quantitative challenge goals to reduce high-level PCBs in equipment in both the U.S. and Canada. In Canada, the challenge goal of a 90 percent reduction of high-level PCBs (>1 percent PCBs or 10,000 ppm, 1993 baseline) in storage has been achieved based on the information available as of December 2004. Canada is still working to meet its in-service challenge goal of a 90 percent reduction of high-level PCBs (>1 percent PCB or 10,000 ppm) by 2006. While the U.S. currently lacks sufficient data to determine the precise status of its progress toward a challenge goal of a 90 percent national reduction of high-level PCBs (>500 ppm) by 2006, substantial progress has been made on this front, as illustrated by the efforts of key stakeholder groups, including electric utilities, in voluntarily removing from service high-level PCB-containing equipment.

Environmental Analysis

Geographic Distribution, Temporal Perspectives, Criteria and Risk

PCBs are monitored in fish, herring gull eggs, bivalves, water and sediments, air, food, and human body burdens. Risk based criteria have been developed for PCB levels in fish, sediments, water, and food. Preliminary analysis of the available data suggests that environmental levels of PCBs exceed water, sediment, and fish tissue criteria in some cases. For example, the GLWQA criterion for PCBs in fish is regularly exceeded, particularly in lake trout. In addition, the issuance of fish consumption advisories for PCBs in the Great Lakes Basin (613 in 2004) indicates that PCBs continue to be present at levels of concern. PCBs are one of the most common cause of fish consumption advisories in the Great Lakes (i.e., in the Lakes proper, not including inland water bodies). Trends in PCB levels in water, sediment, air, fish, and wildlife have generally declined since the 1970s. More recent data (including some data showing PCB spikes) are less clear and need further analysis to delineate trends. For example, some decreasing trends are lake-specific or species/community-specific, making it difficult to draw basin-wide conclusions. PCB levels measured in air in rural areas near each of the Great Lakes have generally declined, but there are some localized hotspots (e.g., the Chicago plume) and some unexplained increases have been observed.

Sources of PCBs

Other potential sources of PCBs include:

- Releases (accidental releases, fires, volatilization) from equipment and other remaining in-service items containing manufactured PCBs;
- Accidental releases from storage/disposal facilities during the handling of PCB wastes;
- Emissions from combustion or incineration of materials containing PCBs;
- Inadvertent formation during certain chemical production processes;
- Reservoirs of past PCB contamination and environmental cycling (e.g., contaminated sediments, soil, and Superfund sites);
- Long-range transport from outside the Great Lakes Basin;

- Other (e.g., dispersive sources from landfills or storage sites).

A better overall understanding of the potential for these sources to contribute to PCB levels in the Great Lakes Basin is needed.

Management Assessment

Key remaining opportunities for the GLBTS to effect further reductions in PCBs include continuing to solicit industry to decommission and dispose of PCBs in electrical equipment, tracking inventoried PCBs in priority industry sectors (high/low-level PCBs in storage and also in service), updating PCB inventory databases on a regular basis, encouraging the ongoing remediation of PCB-contaminated sediment sites, and monitoring environmental trends in the Great Lakes Basin. In addition to voluntary efforts, there are regulatory programs in place in the U.S. to address certain sources of PCBs (e.g., contaminated sites, coplanar PCBs via dioxin control). In 2006, Canada will propose revisions to its existing PCB regulatory framework to set timelines for ending the use of PCBs in equipment and to accelerate PCB destruction. The GLBTS should develop additional information on the relative contributions of all PCB sources to the Great Lakes environment to help prioritize future PCB reduction efforts. The Workgroup should cooperate with the Dioxin Workgroup on common source concerns, such as those where the formation of both dioxins and co-planar PCBs occur. Collateral benefits should be realized for HCB and OCS as well.

Management Outcome

The final management outcome for PCBs is to continue Active Level 1 status with periodic reassessment by the GLBTS. The PCB Workgroup will continue to:

- Target in-service PCB-containing electrical equipment, as the potential remains for the equipment to be a source of future releases;
- Explore non-traditional opportunities to foster PCB reductions through mentoring and outreach programs, financial incentives (e.g., insurance premiums), and ISO registration (in the U.S.);
- Continue the PCB Recognition Award Program; and
- Collect and assess a more complete set of data on PCB sources and environmental levels, in order to prioritize the remaining opportunities for PCB source reductions, and to elucidate PCB trends and impacts on the environment.

3.0 Dioxins and Furans

Challenge Goal Status

Canada has achieved an 87 percent reduction in dioxin releases (1988 baseline) in the Great Lakes Basin against the challenge goal of 90 percent. Canada will continue to work toward this commitment within the Great Lakes Basin. Total annual dioxin releases from inventory sources in Ontario are currently estimated at 35 g (toxic equivalent) TEQ.

The U.S. is confident that it has met the challenge goal of a 75 percent reduction in national dioxin releases. Because the U.S. challenge goal baseline is defined in terms of the U.S. EPA Dioxin Reassessment which is currently undergoing review by the National Academy of Sciences, formal conformation of the challenge goal achievement will have to wait until the release of the final reassessment. The U.S. EPA draft reassessment estimates emissions for the years 1987 and 1995. In May of 2005, U.S. EPA released a draft inventory for the year 2000. This new draft inventory, which is awaiting peer review, estimates total dioxin emissions for 2000 to be approximately 1500 grams TEQ. This is a greater than 90 percent reduction over the draft 1987 baseline estimate.

Environmental Analysis

Geographic Distribution, Temporal Perspectives, Criteria and Risk

In general, there are sufficient data on the presence of dioxins in multiple media to assess impacts in the Basin. These include data in whole fish, fish tissue, herring gull eggs, sediment, water, air, human serum, and food. Current environmental and health criteria information, though limited, is sufficient to conclude that dioxins have a continued adverse impact on the Basin. For the criteria that exist, current data collected in the Great Lakes indicate exceedances of sediment and water quality guidelines. Dioxin contamination triggers fish consumption advisories for at least one species in each of the Great Lakes. While more research is needed to determine a safe level for dioxins in food, the U.S. government has identified significant risks posed by current levels of dioxins found in foods and has recommended steps to reduce exposure (The Interagency Working Group on Dioxins, 2004).

A long-term downward trend in dioxin/furan levels is seen in U.S. and Great Lakes sediment cores, Great Lakes herring gull eggs, and average U.S. and Canadian human body burdens. Long-term temporal trend information is not available for dioxin/furan levels in open water, fish tissue, ambient air, and the commercial food supply. Despite long-term downward trends in dioxin levels in the environment and humans, current trends are less certain in some media (such as ambient air and beef and dairy products). Current environmental levels of dioxins are extremely low, relative to most pollutants, but because of their extreme toxicity and ability to bioaccumulate, their risk potential is significant.

Sources of Dioxin

Dioxin releases to the Great Lakes environment have come from a wide variety of sources. With stringent controls in place on many of the previously dominant industrial and municipal sources,

the largest remaining quantified source in both the U.S. and Ontario is the open burning of household waste. Other major sources include land application of sewage sludge, combustion and incineration, and metals smelting, refining, and processing. In addition to the inventoried sources of dioxin, a number of uncharacterized sources exist. The Dioxin Workgroup has begun to develop estimates for some of these uncharacterized sources, which include wildfires and prescribed burning, structural fires, and agricultural burning.

Management Assessment

While significant reductions of dioxin releases have been achieved in both the U.S. and Canada, additional opportunities for further GLBTS action remain. However, the Workgroup's level of effort focusing on release reductions is expected to decline. The Burn Barrel Subgroup should continue its efforts to actively engage partners on the issue of household garbage burning and to educate public and local officials. U.S. EPA and the Utility Solid Waste Activities Group (USWAG) are preparing a memorandum of understanding (MOU) regarding secondary uses of treated wood. The Workgroup should monitor MOU implementation. The Workgroup should also continue working on pathway intervention and improving the emissions inventory for poorly characterized sources. The Workgroup should evaluate the need for a full Workgroup versus a core group that oversees a few subgroups (e.g., focusing on pathway intervention, source characterization, uncontrolled combustion). The Workgroup should also consider the need to engage new members, such as local government officials, and representatives from the fields of health and agriculture. The Workgroup should coordinate with other Workgroups on common issues such as residential wood burning and coplanar PCBs. The Workgroup should continue to track dioxin levels in the environment and examine the impact of dioxin sources outside the Basin through long-range transport. Setting new quantitative challenge goals would be difficult for the remaining, largely non-point sources of dioxin. Rather than pursue a quantitative challenge goal, the Dioxin Workgroup may consider framing new qualitative challenge goals and examining possible numerical targets for specific sources.

Management Outcome

The recommended management outcome for dioxins and furans is to continue Active Level 1 status. The Dioxin Workgroup will:

- Continue efforts related to household garbage burning;
- Monitor implementation of USWAG/U.S. EPA treated wood MOU;
- Explore exposure pathway intervention opportunities;
- Continue to gather information on poorly characterized sources, including reservoir sources and coplanar PCBs;
- Work toward an integrated air monitoring network within the Great Lakes Basin; and
- Examine the impact of dioxin sources outside the Basin through long-range transport.

4.0 Benzo(a)Pyrene (B(a)P)

Challenge Goal Status

Both Canada and the U.S. have made progress in achieving reductions of B(a)P. Canada has reduced releases in Ontario by approximately 45 percent, relative to a 1988 baseline, and continues to pursue the goal of a 90 percent reduction. However, it is unlikely that Canada will meet its reduction goal by 2006. Total B(a)P releases in Ontario are currently estimated at 29,000 lbs (13,200 kg) per year. The U.S. has reduced B(a)P emissions in the Great Lakes Basin by approximately 77 percent from 1996 to 2001, against a goal of unspecified reductions. Current estimated B(a)P emissions in the U.S. Great Lakes states are 43,700 lbs (19,900 kg) per year.

Environmental Analysis

Geographic Distribution, Temporal Perspectives, Criteria and Risk

In general, basin-wide data indicate that there has been little change in B(a)P concentrations in the Great Lakes environment over the past decade. However, a recent declining trend has been reported in Lake Erie bottom sediment, the only lake with available lakewide sediment data. B(a)P levels in Great Lakes soil and sediment exceed criteria while B(a)P levels in fish tissue, air, and water are below available criteria. Higher concentrations of B(a)P are found on Lakes Erie and Ontario than on the other Great Lakes, at sites near major population centers.

Sources of B(a)P

Eighty percent of Ontario's anthropogenic B(a)P releases are primarily from non-point sources, including: residential wood combustion, use of creosote-treated wood products, motor vehicle emissions, and open burning (prescribed burning and household waste burning). The remaining twenty (20) percent are from iron & steel cokemaking operations. Iron and steel coke ovens remain the largest B(a)P point source in Ontario, though emissions were reduced by 73 percent between 1988 and 2003.

The U.S. Great Lakes inventory is comprised of B(a)P emissions from residential wood combustion, cokemaking, and other sources. Since the 2001 inventory was prepared, it is expected that subsequent coke oven emissions will be lower as a result of additional MACT requirements. Potential sources of B(a)P emissions not listed in the U.S. Great Lakes inventory include: forest and wildfires, residential burning of household waste, scrap tire fires, prescribed burning, and mobile sources. However, forest and wildfires and prescribed burning occur mainly in the Western U.S. and may not contribute significantly to B(a)P levels in the Great Lakes Basin.

The impact of B(a)P is not specific to any one lake basin, though concentrations are higher in the more urban lower lakes and other urban areas such as Chicago. Air monitoring data do not reflect reductions in B(a)P emissions inventories. The absence of a corresponding decrease in the environment indicates that there may be source contributions to the environment that are currently unaccounted for or are underestimated in current inventories.

Management Assessment

The GLBTS has identified a number of opportunities to continue to effect reductions in B(a)P releases to the Great Lakes Basin. These include reducing or preventing B(a)P emissions from residential wood combustion, scrap tire fires, and residential burning of household waste. Other important opportunities include gathering information on emissions from poorly characterized sources, and improving the current emission inventories for Ontario and the U.S. Great Lakes Basin, especially to identify sources that are not included in the inventories. To propose new reduction targets, much effort would be required to develop current and baseline inventories that provide accurate estimates of all potential sources of B(a)P, making it impractical to establish new challenge goals at this time.

Management Outcome

The final management outcome for B(a)P is continued active Level 1 status. The GLBTS B(a)P Workgroup will:

- Continue to pursue reduction activities, especially for the following source sectors:
    1) Residential Wood Combustion: "Burn-it-Smart," wood stove change-out programs, firelog testing, and wood boilers;
    2) Scrap Tires: Ontario Tire Stewardship program, U.S. Best Practices Guidebook, additional training and pile mapping.
- Improve B(a)P inventories by identifying missing sources and source categories that have achieved virtual elimination.
- Determine the co-benefits of reducing Level 2 PAHs resulting from activities that reduce B(a)P emissions.

5.0 Hexachlorobenzene (HCB)

Challenge Goal Status

Both Canada and the U.S. have achieved significant reductions of HCB from sources resulting from human activity. Estimated releases of HCB in the U.S. have been reduced from approximately 8,519 lbs (3,872 kg) in 1990 to 2,911 lbs (1,323 kg) in 1999. In Ontario, releases of HCB have been estimated at 37 lbs (17 kg) in 2003, reduced by approximately 68 percent, relative to a 1988 baseline. This satisfies the U.S. commitment of unspecified reductions. Canada continues to pursue the goal of a 90 percent reduction in HCB releases; however, it is unlikely that this goal will be met by 2006.

Environmental Analysis

Geographic Distribution, Temporal Perspectives, Criteria and Risk

There are sufficient data on the presence of HCB in multiple media to assess its impact in the Basin. The data for HCB show declining concentrations in various media (herring gull eggs, water, sediment, air). There are no HCB triggered fish advisories in the Great Lakes, and HCB levels are below detection limits in fish tissue and human serum in broad national surveys. However, individual research studies have found measurable levels of HCB in tissue samples of residents in the Great Lakes region, including blood and breast milk. A few exceedances of sediment and water quality criteria have been observed in recent years. Continued HCB releases and intercontinental transport may explain the longer-than-expected half-lives for HCB observed in air over the Great Lakes.

Sources of HCB

In addition to HCB releases from sources in the U.S. and Canada, long-range transport and deposition of HCB from elsewhere around the world contribute to loadings in the Great Lakes. HCB is thought to be widely distributed in the global atmosphere with global emissions estimated at 50,600 lbs (23,000 kg). However, the contribution of global HCB concentrations to the Great Lakes is uncertain. It has been estimated that microcontaminant HCB levels in pesticide products in the U.S. have been reduced by at least 95 percent since 1990. Similar reductions have also occurred in Canada. [***the last two sentences need confirmation***] Principal sources of HCB in the U.S. and Ontario are pesticide application (volatilization of HCB as a microcontaminant), residential household waste burning (burn barrels), the manufacture of chemicals and plastics materials, and the use of ferric/ferrous chloride containing trace levels of HCB.

Management Assessment

A number of opportunities for the HCB Workgroup remain. The HCB Workgroup continues to encourage emission reductions from pesticide application and chemical manufacturing. The HCB Workgroup also supports other actions which impact HCB releases, including: 1) Household Garbage Burning Strategy in the Great Lakes Basin (GLBTS Burn Barrel Subgroup);

2) full lifecycle management of pentachlorophenol-treated wood products; and 3) collection of data on HCB levels in the environment. The HCB Workgroup is working to refine HCB emissions estimates for pesticide application, chemical manufacturing, combustion sources, and publicly owned treatment works. The GLBTS believes that establishing new challenge goals for HCB, in either the U.S. or Canada, would provide no added benefit towards achieving further HCB reductions.

Management Outcome

The final management outcome for HCB is continued active Level 1 status. The HCB Workgroup will:

- Improve emission inventories;
- Continue to work with pesticide and chemical manufacturers to reduce HCB emissions, where possible;
- Identify the impact of long-range transport of HCB to the Great Lakes; and
- Determine the co-benefits of reducing specified chlorobenzene compounds as a result of actions that reduce HCB. Collect, report, and use specified chlorobenzene compound information to show benefits related to the reduction of HCB.

6.0 Alkyl-Lead

Challenge Goal Status

Canada has exceeded its challenge goal to reduce alkyl-lead use, generation, and release by 90 percent between 1988 and 2000. Leaded gasoline sales in Ontario declined by almost 99 percent from 1988 to 1997. The U.S. has met the challenge goal to confirm no-use of alkyl-lead in automotive gasoline by 1998 and continues to support and encourage stakeholder efforts to reduce alkyl-lead releases from other sources. Both Canada and the U.S. have prepared challenge reports documenting their status with respect to the challenge goals.

Environmental Analysis and Sources of Lead

Alkyl-lead itself is not a persistent environmental compound, but rapidly degrades to other forms of lead in the environment. Thus, information on the use of alkyl-lead has been employed in place of environmental monitoring data. Most available information on alkyl-lead use in gasoline is limited to older data or is not readily accessible. However, in general, there are sufficient data for GLBTS purposes relative to the remaining sources of alkyl-lead to assess its impact on the Basin. The dominant historic uses of alkyl-lead have been discontinued (e.g., tetraethyllead in gasoline) in North America and in many other countries, and the remaining uses are limited to aviation fuel for piston-engine aircraft, fuel for racing cars, and fuel for off-road and marine vehicles. The remaining significant sources of alkyl-lead are very small compared to historic on-road automotive sources. As a result of Canadian and U.S. regulations, the production of leaded gasoline and its use in on-road vehicles have declined dramatically, as have estimated lead emissions resulting from on-road vehicles. However, in the past decade, with the elimination of routine reporting of leaded automobile gas production, it is more difficult to assess whether the trend in use has continued downward.

Management Assessment

There is little opportunity for the GLBTS to effect further reductions in the remaining uses or releases of alkyl-lead. Both the aviation and automobile racing sectors, the two primary remaining sources of alkyl-lead, would be more effectively addressed at the national level.

Management Outcome

The final management outcome is to suspend GLBTS workgroup activities, and to refer reduction efforts to national programs that address the remaining uses of alkyl-lead. These include efforts by U.S. EPA to:

- Work with racing associations such as the National Association for Stock Car Auto Racing (NASCAR) for voluntary agreements to reduce the use of leaded fuel in race cars;
- Work with the Federal Aviation Administration (FAA) and aviation industry to seek acceptable alternatives to leaded gasoline in aviation fuel; and
- Continued efforts to enhance and promote the phase-out of leaded gasoline use in motor vehicles world-wide.

A periodic reassessment (e.g., at intervals sufficient to elucidate trends) will be undertaken using the General Framework to Assess Management of GLBTS Level 1 Substances, until the Parties determine that virtual elimination has been reached.

7.0 Pesticides

Challenge Goal Status

The GLBTS established challenge goals for both Canada and the U.S., which call for confirmation that there is no longer use or release of the Level 1[4] pesticides from sources that enter the Great Lakes Basin, and for international coordination in the event that long-range sources are confirmed. Both countries have prepared reports confirming that all pesticide uses for all Level 1 pesticides have been canceled, and production facilities have closed in the U.S. and Canada. Although evidence of purposeful release has not been identified, potential release from contaminated sites and remaining unused stocks is still possible. However, ongoing site remediation and waste pesticide collection programs (e.g., Pine River remediation and Clean Sweeps programs) are in place and have continued to make progress in reducing these potential release sources since the preparation of the challenge reports.

For these reasons, we believe that the U.S. and Canada have met the principal intent of their challenges, even though the statement "...no longer use or release..." cannot be confirmed as long as unused stocks and contaminated sites exist. To address the second part of the Level 1 pesticide challenge goals outlined in the Strategy, the U.S. and Canada continue to support international frameworks concerned with reducing or phasing out use and release of these substances world-wide.

Environmental Assessment

Geographic Distribution, Temporal Perspectives, Criteria and Risk

Monitoring data are available on the Level 1 pesticides in fish, herring gull eggs, bivalves, water and sediments, air, food, and human body burdens. Criteria have been developed for fish, sediments, water, and food. These criteria are intended to protect certain populations (e.g., human health, wildlife) or uses (e.g., swimming, drinking water) against unsafe levels of the Level 1 pesticides. Preliminary analyses of available data show exceedances in many areas. Some examples include:

- Fish: Measured concentrations of all of the Level 1 pesticides in Great Lakes fish tissue exceed at least one of the available criteria for the protection of human health; toxaphene levels in larger Lake Superior fish are also high and the cause of fish consumption advisories.
  Eighty-five fish consumption advisories have been issued in the Great Lakes states and Ontario due to chlordane, DDT, mirex, and toxaphene.
- Water: Concentrations of dieldrin, DDT, and toxaphene in most of the Lake waters exceed the GLI water quality guidance criteria for the protection of human health.
- Sediments: Dieldrin and DDT exceeded sediment guidelines associated with probable or severe effects in aquatic life; aldrin and mirex exceeded criteria values representing lowest effect levels.

[4] Aldrin/dieldrin, toxaphene, chlordane, mirex, DDT

Overall, the Level 1 pesticides remain ubiquitous in the Great Lakes environment, and at concentrations that may be of concern for both humans and wildlife.

With regard to trends, available data show that Level 1 pesticides have generally declined over the past twenty years in Great Lakes Basin media. However, due to their persistence and long environmental retention times, declines of the Level 1 pesticides in the Great Lakes environment are slow.

Sources of Pesticides

The Level 1 pesticides have been canceled, production facilities have been closed, and intentional releases have been effectively controlled in the U.S. and Canada. The principal remaining sources of the Level 1 pesticides in the Great Lakes Basin are reservoir sources, including sediments, soils, and localized contaminated industrial sites (Superfund sites). Over 100 National Priority List sites within the eight Great Lakes states show contamination by one or more of the Level 1 pesticides. In addition, ongoing Clean Sweeps collections suggest that significant stored quantities of the Level 1 pesticides exist in the Great Lakes Basin, and thus could represent potential future sources if not stored or disposed of properly. Although available evidence does not suggest new or ongoing sources of Level 1 pesticides in the Great Lakes, the contribution of long-range sources (international and regional) may require further investigation. Continued production and use of the Level 1 pesticides has been reported in India, China, Argentina, and possibly Mexico and Central America.

Management Assessment

Current programs exist to address remaining sources of the Level 1 pesticides in the Basin. These include regulations and activities to reduce remaining stockpiles (e.g., Clean Sweeps conducted at the state and local levels), target reservoir sources (e.g., government remediation activities), and support international programs (e.g., the Stockholm Convention).

Management Outcome

The final management outcome is to suspend GLBTS workgroup activities, and to refer source reduction efforts to state and local Clean Sweep programs and existing government environmental remediation activities. Further reductions in pesticide contamination in the Great Lakes environment will occur over time. The GLBTS will also continue to advocate its interests in international fora (including those targeting pesticide phase out and disposal). A periodic reassessment (e.g., at intervals sufficient to elucidate trends) will be undertaken using the General Framework to Assess Management of GLBTS Level 1 Substances, until the Parties determine that virtual elimination has been reached.

8.0 Octachlorostyrene (OCS)

Challenge Goal Status

The GLBTS established similar goals for the U.S. and Canada, to confirm that there is no longer use or release from sources that enter the Great Lakes Basin. If ongoing, long-range sources of OCS from outside the U.S. and Canada are confirmed, the GLBTS will work within international frameworks to reduce or phase out releases of this substance.

Environmental Assessment

Geographic Distribution, Temporal Perspectives, Criteria and Risk

There is monitoring data for OCS in herring gull eggs (1987-2003), sediment cores, lake trout (Lake Ontario), atmospheric deposition, and human breast milk (Ontario). These data are sufficient to allow for informed management decisions under the GLBTS process. Generally, human health and environmental criteria for OCS have not been established; however, for those that exist, there are generally no exceedances.

Sediment, gull egg, and trout data collectively indicate that OCS has been reduced by more than 90 percent in Lake Ontario, where levels were once the highest. Herring gull egg data indicate a widespread decline in OCS (66 to 90 percent) across all lakes since 1987, but more recent 1997-2003 data show that OCS levels appear to have stabilized at 9 of 15 herring gull colonies, with continued declines at the 6 remaining colonies.

Historically, OCS levels were relatively high in Lakes Erie and Ontario, due to sources along the Niagara River and further upstream. Dated sediment cores indicate that OCS levels in Lake Ontario peaked during the 1960s. More recent surveys of surface sediments at Canadian tributaries to Lake Erie and Lake Ontario (Environment Canada, 2001-2003) detected OCS in none of the 112 tributaries to Lake Ontario, and only 5 of 101 tributaries to Lake Erie.

With regard to atmospheric deposition, OCS has been found in nearly all samples collected at the five Integrated Atmospheric Deposition Network Great Lakes monitoring stations from 1999 to 2002; however, all sites observed a decline in OCS during this time period. OCS deposition is higher at the two sites near Lake Erie and Chicago than the three sites near Lakes Superior and Michigan, which suggests that higher levels are found in urban air-sheds.

A Health Canada study published in 1993 found that, of the 10 provinces studied, OCS residues were detected only in human breast milk samples from Ontario. Health Canada has assessed exposures to the population of Ontario and reported that safety margins for exposure to OCS are 25- to 100-fold under precautionary risk estimates.

Sources of OCS

Electrolytic production of magnesium was among the first recognized sources of OCS. At present, there is one electrolytic magnesium factory in the state of Utah and one operating in the Province of Quebec.
The U.S. and Canada have pooled available information regarding potential sources of OCS and determined that it is currently generated as an unintended byproduct from a variety of industrial processes (although generation may not necessarily imply current release). Five U.S. firms have

recently reported generation and management of OCS wastes to U.S. EPA's Toxics Release Inventory, including three inorganic pigment producers, one chemical and vinyl producer, and one magnesium metal producer; however, other industrial processes may also generate OCS.

There are reasonable grounds for considering that OCS may be produced through processes known to yield chlorinated hydrocarbons. HCB and OCS have close structural similarity, and studies that have analyzed air for both compounds have found both. One reported past source was the chlor-alkali industry; however production technology changes during the 1970s would have ended generation of OCS.

Additional potential candidates for generating OCS, perhaps at low levels, include aluminum foundries and secondary smelters; incinerators; plasma-etching processes in semi-conductor manufacturing; secondary copper smelting; and production of graphite, sodium, nickel, vanadium, niobium, and tantalum. Although there are continuing sources of OCS, improved environmental management of wastes over the past several decades has contributed to declines in levels of this toxic substance across the Great Lakes.

Management Assessment

Potential opportunities to reduce OCS are the same as opportunities to reduce other trace chlorinated hydrocarbon byproducts, such as dioxins and HCB, addressed by the GLBTS. Therefore, sectors that undertake actions to reduce releases of dioxins and HCB will likely also reduce OCS releases as a collateral benefit. Environmental evidence supports the view that there has been substantial progress in reducing releases of OCS in both Canada and the U.S. As OCS is declining in the environment and there appear to be no grounds for concern about this substance, there is no strong case for pursuing further reductions. Overall, there is no rationale for commissioning a new OCS-specific regulation or study.

Management Outcome

The final management outcome is to suspend GLBTS workgroup activities for OCS. There are no known risk-based grounds for new GLBTS activities or challenge goals regarding OCS. The GLBTS will continue to review OCS in environmental biota and media through monitoring programs and long-range transport studies. If additional sources of OCS are identified, they will be addressed through the appropriate forum or program.

9.0 Long-Range Transport

Challenge Goal

The GLBTS established a common goal for both the U.S. and Canada, to "Assess atmospheric inputs of Strategy substances to the Great Lakes. The aim of this effort is to evaluate and report jointly on the contribution and significance of long-range transport of Strategy substances from world-wide sources. If ongoing long-range sources are confirmed, work within international frameworks to reduce releases of such substances."

Since its inception, the GLBTS has addressed this challenge goal by promoting research and discussion and providing a forum for reporting progress on the assessment of the impact of long-range transport (LRT). The most recent of these activities was a two-day workshop on the LRT of Strategy substances, held in Ann Arbor, Michigan, on September 16-17, 2003. Drawing on a commissioned background paper and over 70 experts from around the world, the workshop reviewed the latest research on the global fate and cycling of persistent toxic substances (PTS), identified critical knowledge gaps, and provided recommendations on future activities necessary to adequately address long-range transport. Workshop participants drafted an "Ann Arbor Statement" which contains recommendations aimed at improving our understanding of the LRT of air toxics, particularly with respect to how it impacts the Great Lakes Basin. The Delta Institute presented the final Ann Arbor Statement at a conference of the International Association for Great Lakes Research (IAGLR) in May 2004. The Ann Arbor Statement is available at http://delta-institute.org/pollprev/lrtworkshop/_statement.html.

The Ann Arbor Statement presents the following conclusions:

- U.S. and Canadian governments, in cooperation with international agencies, need to enhance initiatives to better understand LRT.
- If the Great Lakes Basin continues to be a source and a sink of air toxics, the goals of the Great Lakes Water Quality Agreement will never be realized, thereby compromising the health of the ecosystem and its inhabitants.
- Significant financial capital will be required to coordinate and implement the necessary actions. While progress has been made in understanding LRT, work on this challenge goal still remains.

Environmental Analysis

There are not sufficient data on the contribution of LRT to fully assess its impact on the Great Lakes Basin. However, current research indicates that LRT, both intra- and inter-continental, may be a significant source of Strategy substances to the Great Lakes Basin.

Recent studies have investigated the LRT of many PTS substances. Mercury modeling has shown that the Great Lakes Basin is not only affected by mercury emissions from North American sources but also that emissions from Asia and Europe make a significant contribution to the mercury burden over the Great Lakes. The presence of lindane in the air in the Great Lakes region and in the North American Arctic can similarly be traced to contributions from both North American and world-wide sources. The major North American source for toxaphene, a legacy chemical, may be the soils of the southeastern U.S. Although, given the prevailing westerly

winds, these sources should not affect the Great Lakes, there are certain meteorological situations, lasting only a few days, where there is a direct pathway from these southeastern sources to the Great Lakes. Under these conditions toxaphene air concentrations in the Great Lakes Basin are about two to three orders of magnitude greater than those when the winds are westerly and could be a major factor in the net impact on the Great Lakes Basin.

Researchers at Lawrence Berkeley National Laboratory investigated the North American and global scale transfer efficiency of Level 1 substances to the Great Lakes using the Berkeley-Trent (BETR) contaminant fate modeling framework. The modeling results were used to group substances according to the geographic scale of emissions likely to be transported and deposited to the Great Lakes, with the following results: 1) Local or regional scale: aldrin, dieldrin, and B(a)P; 2) Continental-scale: chlordane, dioxin, DDT, toxaphene, OCS, and mirex; 3) Northern hemispheric scale: PCBs; and 4) Global scale: HCB and a-HCH.

Management Assessment

The Ann Arbor Statement identifies a number of actions that are considered to be the most critical scientific and research needs to understand and eventually reduce the LRT of chemicals to the Great Lakes. These actions pertain to emissions inventories, monitoring, modeling, and integration and synthesis. The GLBTS can add value to current efforts by addressing some of these needs through support for: 1) the development of better estimates of the use and emissions of PTS substances both within the Basin and on an appropriate broader scale, 2) air monitoring efforts both in the Basin and in potential source regions upwind of the Basin, 3) improved modeling for informed decision-making, e.g., inter-comparison of models to enhance confidence in the use of such models, 4) investigation of the LRT potential of emerging chemicals, and 5) cooperation with international agencies to reduce emissions at the source.

Two international initiatives, in particular, have a direct impact on reducing the transport of Strategy substances to the Great Lakes. The first is a United Nations Environment Program (UNEP) partnership looking at the fate and transport of substances, primarily mercury. The second is a pesticide initiative in which Canada, the U.S., and China are investigating lindane usage in China and the China-Pacific transport pathway. It is important that the GLBTS participate with these initiatives to further the interests of the Great Lakes region. In addition, implementation of the Stockholm Convention by individual countries will lead to reduced uses and releases of a number of persistent organic pollutants, which should also lead to reduced loadings from other countries to the Great Lakes.

Management Outcome

The current challenge goal for LRT remains relevant, and no changes are recommended at this time. The GLBTS will continue to:

- Support the study of LRT of Strategy substances, including actions to improve emissions inventories, monitoring, and modeling (as recommended in the Ann Arbor Statement);
- Evaluate and report jointly on the contribution and significance of LRT of Strategy substances from world-wide sources; and
- Work within international frameworks to reduce releases.

10.0 Sediments

Challenge Goal Status

The GLBTS established one goal for both the U.S. and Canada, to "Complete or be well advanced in remediation of priority sites with contaminated bottom sediments in the Great Lakes Basin by 2006." Progress toward this goal continues, as reported annually in GLBTS progress reports. Contaminated sediments remain at a number of sites in the Great Lakes. While it is estimated that tens of millions of cubic yards of contaminated sediment remain in priority sites, progress is made each year in the critical evaluation of sediments, identification of remedial needs, and remediation. On average, the U.S. has remediated over 450,000 cubic yards of contaminated sediment each year since 1997. U.S. EPA has a goal of remediating 300,000 cubic yards of contaminated sediment a year. It is anticipated that efforts in 2005 and projected efforts in 2006 will result in remediation of over half a million cubic yards of contaminated sediment by the end of 2006. In Ontario, since GLBTS reporting was initiated, sediment remediation projects have been undertaken at Thunder Bay and the St. Clair River. Decisions on natural recovery and natural recovery with administrative controls have been taken at the Severn Sound and Cornwall/St. Lawrence River Areas of Concern (AOCs), respectively. Work is continuing over the next two years on the development of sediment management strategies in 6 of 10 AOCs with sediment related issues in Ontario. Progress in U.S. AOCs is difficult to assess. Many U.S. AOCs are extremely large and have been broken down into manageable projects within an AOC. These manageable projects can take many years to remediate due to a variety of factors. For example, U.S. EPA, States, and other stakeholders are still assessing the magnitude and scope of contaminated sediment at some of these sites. In some cases, AOC boundaries have yet to be finalized. However, progress is being made every year. Typically, over three projects are initiated and three projects are completed each year. In 2004, work under the Great Lakes Legacy Act began, providing added emphasis to sediment remediation efforts in the Great Lakes. See the annual GLBTS progress reports for details about sediment remediation projects in the Great Lakes.

Environmental Analysis

There are sufficient data on the presence of contaminated sediments in the Great Lakes Basin to describe the degree and spatial extent of contamination based on exceedances of sediment quality criteria. Remedial interventions also involve assessments of toxicity, benthic community impacts, contaminant bioavailability/ biomagnification, and exposure pathways and risks. Although discharges of monitored toxic substances have declined dramatically over the past 30 years, the legacy of contamination persists in the sediments of many rivers and harbors where concentrations of contaminants remain high, and continue to pose potential risks to the health of aquatic organisms, wildlife, and humans.

Management Assessment

Responsibility for the management and remediation of contaminated sites resides variously with federal, state, and provincial governments, industries, and other interested stakeholders. The GLBTS has provided a forum to report on activity and support outreach (for instance, in 2001, the GLBTS held a workshop to promote the transfer of sediment remediation technologies). The

GLBTS reports annually the volume of sediments remediated from priority sites in the Great Lakes Basin (since 1997) and the quantity of Level 1 substances contained in those sediments. Refer to the most current version of the GLBTS Progress Report (at www.binational.net) for the most up-to-date sediment remediation estimates. Aside from the reporting and outreach efforts, the GLBTS provides no further opportunities to add value to current remediation activities.

Management Outcome

The Sediment goal remains relevant to the GLBTS, which supports continuing sediment evaluation and remediation activities at priority sites in the Great Lakes Basin. The GLBTS will continue to report annually the progress made in sediment remediation activities in the Basin, and identify opportunities to support additional information-sharing efforts (similar to the 2001 workshop) as needed.

APPENDIX A: GENERAL FRAMEWORK TO ASSESS MANAGEMENT OF GLBTS LEVEL 1 SUBSTANCES: BACKGROUND, OBJECTIVES, AND DOCUMENTATION

General Framework to Assess Management of GLBTS Level 1 Substances: Background, Objectives, and Documentation

BACKGROUND

Over the past thirty years, the governments of Canada and the United States have joined together with industries, citizen groups, and other stakeholders in a concerted effort to identify and eliminate threats to the health of the Great Lakes ecosystem resulting from the use and release of persistent toxic substances. A major step in this process was the enactment of the *Revised Great Lakes Water Quality Agreement (GLWQA) of 1978* which embraced, for the first time, a philosophy of "virtual elimination" of persistent toxic substances from the Great Lakes. In 1987, the GLWQA was amended, establishing Lakewide Management Plans (LaMPs) as a mechanism for identifying and eliminating any and all "critical pollutants" that pose risks to humans and aquatic life. In 1994, the International Joint Commission's *Seventh Biennial Report* under the GLWQA called for a coordinated binational strategy to "stop the input of persistent toxic substances into the Great Lakes environment." This led to the signing of the *Great Lakes Binational Toxics Strategy* (GLBTS, or Strategy) in 1997. The Strategy specifies Level 1 substances, each targeted for virtual elimination and each with its own specific challenge goals, along with Level 2 substances targeted for pollution prevention. The substances were selected on the basis of their previous nomination to lists relevant to the pollution of the Great Lakes Basin, and the final list was the result of agreement on the nomination from the two countries. The specific reduction challenges for each substance include individual challenge goals for each country, within a time frame that expires in 2006.

Significant progress has been made toward achieving the Strategy's challenge goals. As 2006 approaches, an analysis of progress and determination of next steps is needed to respond to the mandate set forth in the Strategy. The purpose in developing the *General Framework to Assess Management of GLBTS Level 1 Substances* is to provide a tool to assist the Parties (Environment Canada and U.S. EPA) and stakeholders in conducting a transparent process to assess the Level 1 substances.

OBJECTIVE

The framework presents a logical flow diagram for evaluating progress and the need for further action by the GLBTS on the Level 1 substances in order to meet the following objective:

Evaluate the management of GLBTS Level 1 substances with the following potential outcomes:

1) **Active Level 1 Status & Periodic Reassessment by GLBTS**
2) **Consider Submission to BEC[5] for New Challenge Goals**
3) **Engage LaMP Process**

[5] The Binational Executive Committee (BEC) is charged with coordinating implementation of the binational aspects of the 1987 Great Lakes Water Quality Agreement, including the GLBTS. The BEC is co-chaired by EC and US EPA and includes representatives from the Great Lakes states and the Province of Ontario, as well as other federal agencies in Canada and the U.S.

4) **Suspend GLBTS Workgroup Activities. Where warranted, refer to another program and/or participate in other fora. Periodic Reassessment by GLBTS, until Parties determine substance has been virtually eliminated.**

Additional outcomes that may result from the framework are:

- **Recommend benchmark or criteria development as a high priority; and**
- **Recommend additional environmental monitoring as a high priority.**

The framework is intended to serve as a guide in determining the appropriate management outcome(s) for the Level 1 substances: mercury, polychlorinated biphenyls (PCBs), dioxins and furans, hexachlorobenzene (HCB), benzo(a)pyrene (B(a)P), octachlorostyrene (OCS), alkyl-lead, and five cancelled pesticides: chlordane, aldrin/dieldrin, DDT, mirex, and toxaphene. The framework is not intended to specify details of how a Level 1 substance should be addressed once a management outcome is determined.

STRUCTURE OF THE FRAMEWORK

The framework is set up in a hierarchical fashion to allow efficiencies in the decision process. The hierarchy of the framework is to first consider progress toward the challenge goals committed to in the Strategy, then to conduct an environmental analysis and finally, a GLBTS management assessment which leads to various potential management outcomes for a substance.

The environmental analysis (depicted in green) and the GLBTS management assessment (depicted in blue) comprise the two main parts of the framework. The environmental analysis considers available Canadian and U.S. monitoring data and established human health or ecological criteria as the primary basis for an objective evaluation of a substance's impact on the Basin. For substances lacking sufficient risk-based criteria or environmental monitoring data, the framework recommends the development of benchmarks or criteria and additional monitoring as a high priority. While the environmental analysis places emphasis on good monitoring data, evidence of use, release, exposure, or precautionary concerns may also be considered.

If the environmental analysis concludes that there is no basis for concern, GLBTS workgroup activities may be suspended, with periodic reassessment of the substance until the Parties determine that the substance has been virtually eliminated. If, on the other hand, the environmental analysis concludes that there is a reason for concern, the GLBTS management assessment evaluates the ability for the GLBTS to effect further improvements in and out of the Basin. The GLBTS management assessment also considers whether the impact of a substance is basinwide or restricted to a single lake. In cases where the GLBTS can effect further reductions, consideration will be given as to whether new Strategy challenge goals can be established. Virtual elimination is an underlying tenet of the Strategy and should be kept in mind throughout the assessment process.

The GLBTS management assessment can result in a number of potential management outcomes; the outcomes provided in the framework allow a substance to remain in active Level 1 status or GLBTS workgroup activities to be suspended. The outcomes also recognize that it may be appropriate to more actively involve a LaMP process, to refer a substance to another program, to represent GLBTS interests in other fora (e.g., international programs), or to consider proposing new challenge goals. All outcomes include a periodic reassessment by the GLBTS (approximately every two years).

While it is recognized that the Parties have an ongoing responsibility to promote GLBTS interests in other arenas, a potential outcome of the framework is to recommend referral to another program and/or GLBTS representation in other fora. In the GLBTS framework, this option is presented when there is no evidence of Basin effects, or when the GLBTS cannot effect further significant reductions on its own, but can advocate substance reductions in other programs and in international fora.

It should be noted that, in using the framework to conduct assessments for the Level 1 substances, it may not be possible to definitively answer "YES" or "NO" to all questions. It is not necessary to have a definitive answer to proceed in the framework. For example, in assessing whether there is environmental or health data to assess the impact of the substance in the Basin, it may be determined that, while additional data would be helpful, there is some data on releases and environmental presence in certain media with which to assess the status of the substance. In this case, judgment is needed to decide whether these data are sufficient to proceed along the "YES" arrow or whether the available data are not adequate and the analysis should proceed along the "NO" arrow, placing the substance on a high priority list for monitoring. As a general guide, the framework allows flexibility and judgment in interpreting environmental data and in determining the most appropriate management outcome(s).

Each decision node, or shape, in the framework is illustrated below along with a brief explanation that describes, in further detail, the question to be assessed.

GLBTS Level 1 Substances

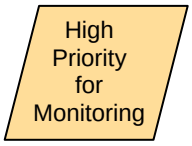
All 12 Level 1 substances will be assessed.

Have the challenge goals for the substance been met?

The first question to consider in assessing the GLBTS status and future management of a Level 1 substance is whether the challenge goals agreed to in the Strategy have been met. The answer to this question informs the subsequent assessment in many ways, not only indicating progress, but also revealing issues associated with the ability to pursue further reductions. Progress toward the U.S. and Canadian goals will be considered jointly. Challenge goals will be evaluated with the best data presently available. Note that some challenge goals target "releases" of a substance while others target its "use". As a result, different types of data may be required to evaluate challenge goal status (e.g., "use" data vs. environmental "release" data). The framework continues with both the environmental analysis and GLBTS management assessment, notwithstanding the status of the challenge goals.

ENVIRONMENTAL ANALYSIS

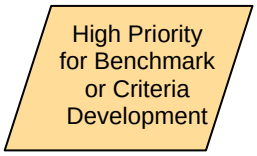
Characteristics of acceptable monitoring data to assess the temporal, spatial, and population representativeness of a substance in the Great Lakes Basin ecosystem include (but are not limited to) basin-specific measures in water, air, sediment, soil, indoor environments (e.g., dust), fish, biota, or human biological samples. If necessary, use or release data may be used as surrogates (e.g., in the case of alkyl-lead).



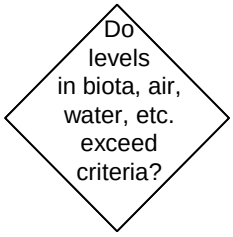
"What gets measured gets managed." Substances entering this box will be recommended as a high priority for monitoring to the Parties. The intent is that these GLBTS substances will be considered by a wide range of government or private agencies when they make decisions regarding which analytes to monitor in the environment. As sufficient monitoring data is developed, substances will be re-evaluated.

Relevant criteria include, but are not limited to:

- Water quality criteria
- Fish tissue concentrations
- Ambient or indoor air standards
- Sediment or soil standards
- Limits based on reference doses
- Health-based standards for human biota measurements



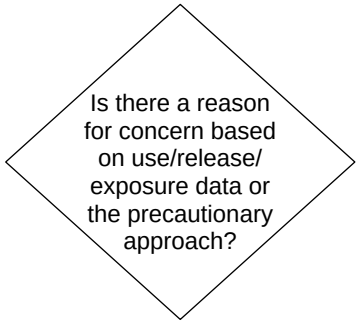
If there are no criteria against which to evaluate current levels, the GLBTS will consider whether there is a need for the Parties to recommend the development of human health or ecological criteria. This box effectively creates a GLBTS list of substances that are in need of human health or ecological criteria with which to identify exceedances in the environment.



As the framework is intended to be flexible in its implementation, the choice of criteria to use in answering this question may vary. For example, the most strict criteria in one or more media may be used to evaluate environmental levels.

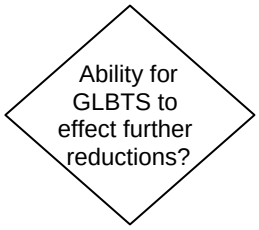
If there are no criteria, or if current levels do not exceed criteria, this box considers whether there is a decreasing trend. A decreasing trend could be defined as a statistically significant negative slope. If the trend is decreasing, the substance is evaluated for evidence of concern based on use, release, exposure, or the precautionary approach. If a decreasing trend cannot be established, then the substance moves directly to the GLBTS management assessment to determine the ability of the GLBTS to effect further reductions.

* Note that, in the event that there are established criteria and the GLBTS substance is below those criteria but not decreasing in trend, further analyses may be required to estimate when criteria might be exceeded.

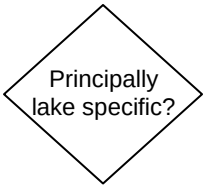


In cases where sufficient monitoring data is not available, or where environmental trends are decreasing and criteria have either not been established or are not being exceeded, the relevant question is whether there is evidence of Basin effects based on documented use, release, or exposure data, or from a precautionary point of view. An example of a precautionary point of view would be documented evidence of significant impact in another geographic location with the same sources and use patterns as in the Basin, or because the effects of a pollutant would be significant by the time it was able to be measured through monitoring.

GLBTS MANAGEMENT ASSESSMENT



Answering this question involves an accelerated version of the first three steps of the GLBTS 4-step process,[6] looking at sources and current programs and regulations to see where the reduction opportunities lie. Part of the assessment will involve consideration of whether the reduction opportunities will be significant enough to merit the effort.



Based on a joint GLBTS-LaMP determination that the impact of a substance is restricted to a single lake, the appropriate LaMP will be engaged for coordination of leadership for reduction actions to be undertaken by the responsible organizations.

The GLBTS will assess the practicality of setting forth new challenge goals.

[6] The GLBTS four-step process to work toward virtual elimination is: 1) Information gathering; 2) Analyze current regulations, initiatives, and programs which manage or control substances; 3) Identify cost-effective options to achieve further reductions; and 4) Implement actions to work toward the goal of virtual elimination.

GLBTS MANAGEMENT OUTCOMES

Active Level 1 Status & Periodic Reassessment by GLBTS

The substance will continue as a Level 1 with reduction actions addressed by the appropriate process and with periodic reassessment, approximately every two years, using the *General Framework to Assess Management of GLBTS Level 1 Substances*.

Consider Submission to BEC for New Challenge Goals

The GLBTS will consider recommending new challenge goals to BEC. The justification for new challenge goals will incorporate the findings of the framework analysis and will include assessment of the desired environmental improvement and feasibility. If the GLBTS decides to propose new challenge goals, the recommendation to BEC will include a reduction percentage, reduction timeline, and baseline for the proposed new challenge goals.

Engage LaMP Process

For substances whose impact is lake-specific, the appropriate LaMP will be engaged to coordinate substance reduction activities with continued support from the GLBTS, recognizing the limited direct implementation capacity of the LaMPs. It is understood that much of the actual implementation would be carried out by the agencies with responsibility to address these substances. A joint review of progress would be undertaken periodically.

Suspend GLBTS Workgroup Activities. Where warranted, refer to another program, and/or participate in other fora. Periodic Reassessment by GLBTS, until Parties determine substance has been virtually eliminated.

In the event that the GLBTS is not able to effect further reductions, or there is no evidence of Basin effects, GLBTS workgroup activities will be suspended. Where warranted, a recommendation will be made to a) refer reduction efforts for the substance to another program, and/or b) represent GLBTS interests in other fora (e.g., Commission for Environmental Cooperation, United Nations Environment Programme). There will be no ongoing workgroup involvement with these substances, though each one will undergo periodic reassessment, approximately every two years, using the *General Framework to Assess Management of GLBTS Level 1 Substances*, until the Parties determine that virtual elimination has been reached.

General Framework to Assess Management of GLBTS Level 1 Substances